

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
31 October 2002 (31.10.2002)

PCT

(10) International Publication Number
WO 02/085620 A1

(51) International Patent Classification⁷: **B32B 27/08**,
27/28

(21) International Application Number: PCT/US02/11849

(22) International Filing Date: 23 April 2002 (23.04.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/285,225 23 April 2001 (23.04.2001) US

(71) Applicants (for all designated States except US):
KANEKA CORPORATION [JP/JP]; 2-4, Nakanoshima
3-chome, Kita-ku, Osaka-shi, Osaka 530-0005 (JP).
KANEKA TEXAS CORPORATION [US/US]; 6161
Underwood Road, Pasadena, TX 77507 (US).

(71) Applicants and

(72) Inventors: **NISHIMURA, Richi** [JP/US]; 330 Meadow
Wood Ct., League City, TX 77573 (US). **SUGAYA,**
Takahiko [JP/US]; 1400 El Camino Village Drive #901,
Houston, TX 77058 (US).

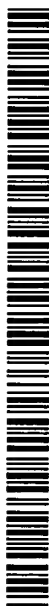
(74) Agent: **HANSON, Donald, W.**; Armstrong, Westerman &
Hattori, LLP, Suite 1000, 1725 K Street N.W., Washington,
DC 20006 (US).

(81) Designated States (*national*): AU, CA, CN, JP, US.

Published:

- with international search report
- before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.



WO 02/085620 A1

(54) Title: RESIN COMPOSITION FOR CAPSTOCK

(57) Abstract: A resin composition for capstock, comprising 100 to 30 parts by weight of an impact resistance modifier having a multilayer structure, and 0 to 70 parts by weight of a methyl methacrylate (co)polymer containing 50 to 100 % by weight of methyl methacrylate and 50 to 0 % by weight of a monomer which is copolymerizable therewith, wherein the total amount of the impact resistance modifier and the methyl methacrylate (co)polymer is 100 parts by weight, wherein the outer layer of said impact resistance modifier and/or said methyl methacrylate copolymer is copolymerized with 0.5 to 40 % by weight of a reactive monomer based on the total amount of the impact resistance modifier and the methyl methacrylate (co)polymer as a polymer component, and wherein the homopolymer of said reactive polymer has an SP value of $9.8 \text{ (cal/cm}^3)^{1/2}$ or more.

1/31

DESCRIPTION

RESIN COMPOSITION FOR CAPSTOCK

FIELD OF THE INVENTION

The present invention relates to a resin composition for capstock comprising an impact resistance modifier having a multilayer structure. Specifically, the present invention relates to a resin composition for capstock having excellent impact resistance, weather resistance and processability and low gloss.

BACKGROUND OF THE INVENTION

Acrylic resins are well known to have excellent weather resistance. By making use of this characteristic, they are used as a capstock for a material requiring weather resistance. For example, U.S. Patent 4,198,520 discloses improvement of weather resistance of the surface of a molding made of a material inferior in weather resistance such as ABS resin, PVC resin or the like by using an acrylic resin as a capstock for the surface. U.S. Patent 5,318,737 and WO00/08098 discloses preparation of an acrylic resin composition suited for use as a capstock excellent in weather resistance and impact resistance by adding a rubber component to an acrylic resin.

2/31

However, acrylic resins are fragile materials so that addition of a large amount of rubber thereto is necessary for attaining impact resistance enough for satisfying the market demand, which leads to a deterioration in processability and surface hardness. A capstock well balanced between impact resistance and processability does not exist at present.

DISCLOSURE OF THE INVENTION

An object of the present invention is to provide, under the above situations, a capstock having excellent impact resistance, weather resistance, surface hardness and processability which cannot so far be attained by the conventional acrylic resins.

The present inventors have carried out an extensive investigation. As a result, it has been found that a capstock having excellent impact resistance, weather resistance, processability and surface hardness can be obtained by copolymerizing a so-called polar monomer with, in an acrylic resin composition comprising an impact resistance modifier, the outer layer of the impact resistance modifier and/or the acrylic copolymer. Thus the present invention has been completed.

Specifically, the present invention relates to:

- (1) A resin composition for capstock, comprising:

3/31

100 to 30 parts by weight of an impact resistance modifier having a multilayer structure, and

0 to 70 parts by weight of a methyl methacrylate (co)polymer containing 50 to 100% by weight of methyl methacrylate and 50 to 0% by weight of a monomer which is copolymerizable therewith,

wherein the total amount of the impact resistance modifier and the methyl methacrylate (co)polymer is 100 parts by weight,

wherein the outer layer of said impact resistance modifier and/or said methyl methacrylate copolymer is copolymerized with 0.5 to 40% by weight of a reactive monomer based on the total amount of the impact resistance modifier and the methyl methacrylate (co)polymer as a polymer component, and

wherein the homopolymer of said reactive polymer has an SP value of $9.8 \text{ (cal/cm}^3)^{1/2}$ or more.

(2) The resin composition according to (1), wherein the outer layer of said impact resistance modifier and/or said methyl methacrylate (co)polymer is copolymerized with 1 to 20% by weight of the reactive monomer based on the total amount of the impact resistance modifier and the methyl methacrylate (co)polymer.

(3) The resin composition according to (1), wherein the SP value of the reactive monomer is $10.8 \text{ (cal/cm}^3)^{1/2}$ or more.

4/31

(4) The resin composition according to (1), wherein the impact resistance modifier and the methyl methacrylate (co)polymer are contained in 80 to 40 parts by weight and 20 to 60 parts by weight, and the total amount thereof is 100 parts by weight.

(5) The resin composition according to (1), wherein the reactive monomer is one or at least two of a monomer having a nitrile group, an epoxy group, a glycidyl group, a hydroxyl group, a carboxylic acid group, an aldehyde group, an amino group or an amide group.

(6) The resin composition according to (1), wherein the impact resistance modifier has a two-layer structure and is obtained by polymerizing a monomer mixture containing a (meth)acrylic ester and a copolymerizable monomer in the presence of a crosslinked acrylic rubber.

(7) The resin composition according to (1), wherein the impact resistance modifier has a three-layer structure and is obtained by polymerizing an alkyl acrylate, a copolymerizable monomer and a crosslinking monomer in the presence of a polymer obtained by polymerizing methyl methacrylate, a copolymerizable monomer and a crosslinking monomer and then polymerizing a monomer mixture containing a (meth)acrylic ester and a copolymerizable monomer in the presence of the resulting two-layer polymer.

(8) The resin composition according to (1), wherein a weight ratio of the crosslinked rubber portion and the

5/31

outer layer portion of said impact resistance modifier according to (6) or (7) is 15/85 to 95/5.

(9) The resin composition according to (1), wherein the capstock is a capstock for a siding panel made of polyvinyl chloride.

(10) A siding panel obtained by extrusion-molding the resin composition according to (1) as a capstock and a polyvinyl chloride resin as a substrate.

(11) A siding panel obtained by extrusion-molding the resin composition according to (1) as a capstock and a polyvinyl chloride resin as a substrate using a multimanifold die.

BEST MODE FOR CARRYING OUT THE INVENTION

Hereinafter, the terms "part(s) by weight" and "% by weight" are simply referred to as "part(s)" and "%", respectively, unless otherwise indicated.

The methyl methacrylate (co)polymer can be obtained by copolymerizing methyl methacrylate with a monomer which is copolymerizable therewith. Furthermore, it is obtained by copolymerizing 50 to 100% of methyl methacrylate with 0 to 50% of a monomer which is copolymerizable therewith. Amounts of methyl methacrylate less than 50% are insufficient for bringing about weather resistance improving effects of a capstock molding so that they are not preferred. The amount of methyl methacrylate is

6/31

preferably 60 to 98%, more preferably 75 to 90%. Examples of the monomer which is copolymerizable with methyl methacrylate include an aromatic vinyl, an acrylic ester, a methacrylic ester other than methyl methacrylate, and the like.

The aromatic vinyl includes styrene, α -methylstyrene, chlorostyrene and the like.

The acrylic ester includes ethyl acrylate, butyl acrylate, n-octyl acrylate, 2-ethylhexyl acrylate.

The methacrylic ester includes ethyl methacrylate, butyl methacrylate, n-octyl methacrylate, 2-ethylhexyl methacrylate and the like.

They may be used either alone or in combination.

The copolymer of methyl methacrylate and a monomer which is copolymerizable therewith is obtained by emulsion polymerization, suspension polymerization, bulk polymerization, solution polymerization or the like. Among these, bulk polymerization is especially preferred because of a small content of impurities in the polymer.

The impact resistance modifier having a multilayer structure is a multilayer polymer obtained by one-stage or at least two-stage polymerization of a vinyl monomer in the presence of rubbery polymer particles. Examples of the rubbery polymer include acrylic rubber, diene rubber, silicone rubber and the like. Examples of the diene rubber include polybutadiene rubber, isoprene rubber, SBR, NBR and

7/31

the like. Among these, acrylic rubber is preferred because they do not deteriorate the weather resistance of capstock obtained using it and the cost is low. Examples of the acrylic rubber include n-butyl acrylate rubber, n-octyl acrylate rubber, 2-ethylhexyl acrylate rubber and the like. As these rubbers, crosslinked rubber is usually employed. A compound used for the formation of the crosslinked structure is preferably allyl methacrylate, allyl acrylate, diallyl maleate, diallyl fumarate, diallyl itaconate, monoallyl maleate, butadiene, divinyl benzene or the like. They are used either alone or in combination.

The impact resistance modifier having a multilayer structure is usually prepared by carrying out one-stage or at least two-stage polymerization of 85 to 10% of a vinyl monomer in the presence of 15 to 90% of crosslinked rubber particles. The amount of the crosslinked rubber particles is preferably 25 to 80%, more preferably 30 to 70%. Amounts within this range are preferred from the viewpoints of processability and weather resistance. The crosslinked rubber particles may contain, as the core, a rigid polymer in their inner layers. Examples of the vinyl monomer to be polymerized in the presence of rubbery polymer particles include methyl methacrylate, ethyl methacrylate, methyl acrylate, ethyl acrylate, butyl acrylate, styrene and the like. Any one of emulsion polymerization, suspension polymerization, bulk polymerization and solution

10/31

more. The amount of the reactive monomer is preferably 0.5 to 40%, more preferably 1 to 20%.

Various thermoplastic resins such as a polyvinyl chloride resin, an ABC resin and the like are employed as a substrate for capstock. Among these, the polyvinyl chloride resin is preferred from the viewpoint of processability and weather resistance.

Siding sheets may be processed by laminating extrusion through a popularly used die such as feed block die or multimanifold die. The multimanifold die is preferred because use of it permits production of a good sheet even if a capstock and a substrate which are different in viscosity are used in combination, and facilitates control of thickness of the sheet.

There is no particular limitation imposed on a process for preparing the acrylic resin composition of the present invention. An acrylic resin composition containing crosslinked rubber particles may be polymerized in one operation, or an acrylic resin may be mixed with an impact resistance modifier. Additives such as an antioxidant, light stabilizer, lubricant, pigment and the like may be added as needed.

The present invention will hereinafter be described based on Examples and Comparative Examples. However, the present invention is not limited thereto.

11/31

Example 1

Preparation of methyl methacrylate copolymer:

In a reactor equipped with a stirrer were charged 200 parts of water and 0.5 part of sodium dioctylsuccinate. After oxygen was removed from the space and water in the reactor by nitrogen purging, the mixture was heated to 70°C under stirring. To the reaction mixture were added 0.004 part of sodium ethylenediaminetetraacetate, 0.002 part of ferrous sulfate 7 hydrate, and 1 part of sodium formaldehyde sulfoxylate. Then, a mixture of 73 parts of methyl methacrylate, 15 parts of butyl acrylate, 12 parts of acrylonitrile and 1 part of t-butyl hydroperoxide was added continuously over 4 hours. Two hours after addition was started, 0.5 part of sodium dioctylsuccinate was added in one operation. After completion of the continuous addition of the mixture, 0.1 part of t-butyl hydroperoxide and 0.1 part of sodium formaldehyde sulfoxylate were added. Fifty minutes after completion of the addition, 0.1 part of t-butyl hydroperoxide was added. Ten minutes after that, 0.1 part of sodium formaldehyde sulfoxylate was added. After completion of the addition, the mixture was maintained at the same temperature for 1 hour to complete the polymerization. The methacrylic acid copolymer latex thus obtained was subjected to salting-out and coagulation, heat treatment and drying in a known manner, whereby a

12/31

methyl methacrylate copolymer was obtained as white powder. A monomer-to-polymer conversion ratio was 96%.

Preparation of two-layer impact resistance modifier:

(a) Preparation of rubbery polymer

The mixture described below was charged in a glass reactor. While stirring in a nitrogen gas stream, the mixture was heated to 50°C. A monomer mixture of 100 parts of n-butyl acrylate, 1 part of allyl methacrylate and 0.1 part of cumene hydroperoxide was added over 4 hours. Simultaneously with the addition of the monomer mixture, a 5% aqueous solution of 2 parts of potassium stearate was added continuously over 4 hours. After the addition was completed, stirring was continued for 5 hours to complete the polymerization. A monomer-to-polymer conversion ratio was 97% and the polymer thus obtained was found to have an average particle size of 1300 Å.

Mixture:	(parts)
Deionized water	180
Potassium stearate	0.1
Formaldehyde sodium sulfoxylate	0.2
Sodium ethylenediaminetetraacetate	0.01
Ferrous sulfate heptahydrate	0.005

13/31

(b) Preparation of outer layer

In a glass reactor were charged 70 parts (as a solid content) of the crosslinked rubbery polymer latex obtained in (a), 0.08 part of sodium formaldehyde sulfoxylate, 0.02 part of sodium ethylenediaminetetraacetate and 0.01 part of ferrous sulfate heptahydrate. At 50°C, the aqueous dispersion was stirred under heating in a nitrogen gas stream. Over one hour, 26 parts of methyl methacrylate and 4 parts of butyl acrylate, as monomer components for graft polymerization, and, as a polymerization initiator, 0.05 part of cumene hydroperoxide were added continuously. After completion of the addition, 0.01 part of cumene hydroperoxide was added. Stirring was continued for 2 hours to complete the polymerization. A monomer-to-polymer conversion ratio was 98%. The graft copolymer latex having a multilayer structure thus obtained was then subjected to salting-out and coagulation, heat treatment and drying in a known manner to thereby obtain a two-layer impact resistance modifier as white powder.

Preparation of resin composition:

To 45 parts of the resulting impact resistance modifier and 55 parts of the methyl methacrylate copolymer, 100 parts in total, were added 0.2 part of an olefin lubricant ("ACPE-629A", manufactured by Allied Signal Inc.)

14/31

and 1 part of an ultraviolet absorber ("TINUVIN-P", manufactured by Ciba Specialty Chemicals). The resulting mixture was kneaded in a twin-screw kneader, followed by pelletization. From the pellets, a sheet of 40 mil thick was formed by a T-die twin screw extruder.

The Gardner impact resistance (G.I., unit: inch-lb/mil) at 23°C of the sample thus obtained was measured in accordance with ASTM D4226-93. The results are shown in Table 1.

Example 2

In the same manner as in Example 1 except that the composition of the monomer mixture for a methyl methacrylate copolymer was changed to 73 parts of methyl methacrylate, 15 parts of butyl acrylate and 12 parts of glycidyl methacrylate and the composition of the monomer mixture for the outer layer of an impact resistance modifier was changed to 25 parts of methyl methacrylate and 5 parts of acrylonitrile, a methyl methacrylate copolymer and an impact resistance modifier were prepared, followed by pelletization and formation of a sheet. The sheet was evaluated in the same manner as in Example 1 and the results are shown in Table 1.

15/31

Example 3

In the same manner as in Example 2 except that the composition of the monomer mixture for a methyl methacrylate copolymer was changed to 73 parts of methyl methacrylate, 15 parts of butyl acrylate and 12 parts of 2-hydroxyethyl acrylate, a methyl methacrylate copolymer and an impact resistance modifier were prepared, followed by pelletization and formation of a sheet.

The sheet was evaluated in the same manner as in Example 1 and the results are shown in Table 1.

Example 4

In the same manner as in Example 1, a methyl methacrylate copolymer was prepared, while in the same manner as in Example 2, an impact resistance modifier was prepared. They were kneaded and pelletized in the same manner as in Example 1, followed by formation of a sheet.

The sheet was evaluated in the same manner as in Example 1 and the results are shown in Table 1.

Example 5

(a) Preparation of rubbery polymer

A rubbery polymer was prepared in the same manner as in Example 1.

16/31

(b) Polymerization of outer layer

In a glass reactor were charged 32 parts (as a solid content) of the crosslinked rubbery polymer latex obtained in (a), 0.17 part of sodium formaldehyde sulfoxylate, 0.044 part of sodium ethylenediaminetetraacetate and 0.022 part of ferrous sulfate heptahydrate. At 50°C, the aqueous dispersion was stirred under heating in a nitrogen gas stream. Then, as monomer components for graft polymerization, 48 parts of methyl methacrylate, 10 parts of butyl acrylate and 10 parts of acrylonitrile, and, as a polymerization initiator, 0.13 part of cumene hydroperoxide were added continuously over 2.5 hours. After completion of the addition, 0.17 part of cumene hydroperoxide and 0.2 part of sodium formaldehyde sulfoxylate were added. One hour thereafter, 0.17 part of cumene hydroperoxide and 0.2 part of sodium formaldehyde sulfoxylate were added. Stirring was continued for 2 hours to complete the polymerization. A monomer-to-polymer conversion ratio was 96%. The graft copolymer latex having a multilayer structure thus obtained was then subjected to salting-out and coagulation, heat treatment and drying in a known manner to thereby obtain a white powdery product.

18/31

Table 1

	Ex.1	Ex.2	Ex.3	Ex.4	Ex.5	Comp. Ex.1
Monomer	AN	AN & GMA	AN & HA	AN	AN	
SP value (cal/cm ³)	12.8	12.8&11.9	12.8&11.5	12.8	12.8	
Amount (%)	6.6	6.6&2.3	6.6&2.3	6.6&2.3	10.0	0
G.I. (inch·lb/mil)	0.86	0.84	0.99	0.80	1.24	0.10

AN: Acrylonitrile

GMA: Glycidyl methacrylate

HA: 2-Hydroxyethyl acrylate

Example 6

An impact resistance modifier similar to that used in Example 2 and as a methyl methacrylate copolymer, "ACRYLITE M-30-003" (trade name; manufactured by CYRO Industries) were used. In the same manner as in Example 1, 55 parts of the methyl methacrylate copolymer and 45 parts of the impact resistance modifier were pelletized, followed by formation into a sheet. The sheet was evaluated in the similar manner as in Example 1 and the results are shown in Table 2.

Example 7

As a methyl methacrylate copolymer, "ACRYLITE M-30-003" (trade name; manufactured by CYRO Industries) was used as in Example 6.

19/31

Preparation of impact resistance modifier:

(a) Preparation of rubbery polymer

A rubbery polymer was prepared in the same manner as in Example 1.

(b) Preparation of outer layer

In a glass reactor were charged 60 parts (as a solid content) of the crosslinked rubbery polymer latex obtained in (a), 0.11 part of sodium formaldehyde sulfoxylate, 0.026 part of sodium ethylenediaminetetraacetate and 0.013 part of ferrous sulfate heptahydrate. At 50°C, the aqueous dispersion was stirred under heating in a nitrogen gas stream. Then, as monomer components for graft polymerization, 33 parts of methyl methacrylate and 7 parts of acrylonitrile and, as a polymerization initiator, 0.07 part of cumene hydroperoxide were added continuously over 2 hours. After completion of the addition, 0.17 part of cumene hydroperoxide and 0.2 part of sodium formaldehyde sulfoxylate were added. One hour later, 0.17 part of cumene hydroperoxide and 0.2 part of sodium formaldehyde sulfoxylate were added. Stirring was continued for 1 hour to complete the polymerization. A monomer-to-polymer ratio was 97%. The graft copolymer latex having a multilayer structure thus obtained was then subjected to salting-out and coagulation, heat treatment

20/31

and drying in a known manner to thereby obtain a white powdery product.

Preparation of resin composition:

As in Example 1, a mixture obtained by adding 0.2 part of an olefin lubricant ("ACPE-629A", manufactured by Allied Signal Inc.) and 1 part of an ultraviolet absorber ("TINUVIN-P", manufactured by Ciba Specialty Chemicals) to 47.5 parts of a methyl methacrylate copolymer and 52.5 parts of the resulting impact resistance modifier was kneaded in a twin-screw kneader, followed by pelletization and formation of a sheet.

The sheet was evaluated in the same manner as in Example 1 and the results are shown in Table 2.

Example 8

As a methyl methacrylate copolymer, "ACRYLITE M-30-003" (trade name; manufactured by CYRO Industries) was used as in Example 6.

Preparation of impact resistance modifier:

(a) Preparation of rubbery polymer

A rubbery polymer was prepared in the same manner as in Example 1.

21/31

(b) Preparation of outer layer

In a glass reactor were charged 40 parts (as a solid content) of the crosslinked rubbery polymer latex obtained in (a), 0.16 part of sodium formaldehyde sulfoxylate, 0.04 part of sodium ethylenediaminetetraacetate and 0.02 part of ferrous sulfate heptahydrate. At 50°C, the aqueous dispersion was stirred under heating in a nitrogen gas stream. Then, as monomer components for graft polymerization, 49 parts of methyl methacrylate and 11 parts of acrylonitrile and, as a polymerization initiator, 0.08 part of cumene hydroperoxide were added continuously over 3 hours. After completion of the addition, 0.17 part of cumene hydroperoxide and 0.2 part of sodium formaldehyde sulfoxylate were added. One hour thereafter, 0.17 part of cumene hydroperoxide and 0.2 part of sodium formaldehyde sulfoxylate were added. Stirring was continued for 1 hour to complete the polymerization. A monomer-to-polymer conversion ratio was 96%. The graft copolymer latex having a multilayer structure thus obtained was then subjected to salting-out and coagulation, heat treatment and drying in a known manner to thereby obtain a white powdery product.

Preparation of resin composition:

As in Example 1, a mixture obtained by adding 0.2 part of an olefin lubricant ("ACPE-629A", manufactured by

23/31

Example 10

Preparation of three-layer impact resistance modifier:

(a) Preparation of innermost layer

In a glass reactor was charged a mixture having the below-described composition. While stirring in a nitrogen gas stream, the mixture was heated to 80°C. In the reactor was charged 20% of a mixture, as the innermost layer component, composed of 35 parts of methyl methacrylate, 0.14 part of allyl methacrylate and 0.14 part of t-butyl hydroperoxide in one operation and polymerization was conducted for 45 minutes.

Mixture:	(parts)
Deionized water	220
Boric acid	0.3
Sodium carbonate	0.03
Sodium N-lauroylsarcosinate	0.09
Sodium formaldehyde sulfoxylate	0.09
Sodium ethylenediaminetetraacetate	0.006
Ferrous sulfate heptahydrate	0.002

Over 1 hour, 80% of the remaining portion of the mixture was then added continuously. After completion of the addition, the mixture was maintained at the same temperature for 2 hours to complete the polymerization. During this time, 0.2 part of sodium N-lauroylsarcosinate

24/31

was added. The polymer particles in the crosslinked methacrylic polymer latex serving as an innermost layer had an average particle size of 1600 Å (determined by making use of scattering of a light having a wavelength of 546 nm) and a monomer-to-polymer conversion ratio (preparation amount of polymer/amount of monomer charged \times 100) was 98%.

(b) Preparation of rubbery polymer

The crosslinked methacrylic polymer latex obtained above in (a) was maintained at 80°C in a nitrogen gas stream. After addition of 0.1 part of potassium persulfate, a monomer mixed solution of 52 parts of n-butyl acrylate, 13 parts of styrene and 1 part of allyl methacrylate was added continuously over 5 hours. During the addition, 0.1 part of potassium oleate was added in 3 portions. After completion of the addition of the monomer mixed solution, 0.05 part of potassium persulfate was added further in order to complete the polymerization and the mixture was maintained for 2 hours. The polymer thus obtained had an average particle size of 2300 Å and a monomer-to-polymer conversion ratio was 99%.

(c) Preparation of outermost layer

After addition of 0.02 part of potassium persulfate to 75 parts of the rubbery polymer latex which had been obtained above in (b) and maintained at 80°C, a mixed

25/31

solution of 20 parts of methyl methacrylate and 5 parts of acrylonitrile were added continuously over 1 hour. After completion of the addition of the monomer mixed solution, 0.02 part of potassium persulfate was added and the resulting mixture was maintained for 2 hours to thereby obtain a multilayer graft copolymer latex. The graft copolymer having a multilayer structure had an average particle size of 2530 Å and a monomer-to-polymer conversion ratio was 97%. The resulting multi-layer graft copolymer latex was subjected to salting-out and coagulation, heat treatment and drying in a known manner to thereby obtain a multilayer graft copolymer as white powder.

Preparation of resin composition:

The resulting impact resistance modifier (45 parts) and as a methyl methacrylate copolymer, 55 parts of ACRYLITE M-30-003" (trade name; manufactured by CYRO Industries) were used. In a similar manner to Example 1, they were pelletized, followed by formation into a sheet. The sheet was evaluated in the same manner as in Example 1 and the results are shown in Table 2.

26/31

Table 2

	Ex. 6	Ex. 7	Ex. 8	Ex. 9	Ex. 10	Comp. Ex. 2
Monomer	AN	AN	AN	GMA	AN	
SP value (cal/cm ²)	12.8	12.8	12.8	11.9	12.8	
Amount used (%)	2.3	3.7	8.7	2.3	2.3	0
G.I. (Inch· lb/mil)	0.89	1.21	4.62	1.05	1.08	0.59

AN: Acrylonitrile

GMA: Glycidyl methacrylate

INDUSTRIAL APPLICABILITY

By using the acrylic resin composition of the present invention as a capstock, a siding panel excellent in weather resistance, impact resistance, surface hardness and processability and having a low gross can be obtained.

27/31

CLAIMS

1. A resin composition for capstock, comprising:
100 to 30 parts by weight of an impact resistance modifier having a multilayer structure, and

0 to 70 parts by weight of a methyl methacrylate (co)polymer containing 50 to 100% by weight of methyl methacrylate and 50 to 0% by weight of a monomer which is copolymerizable therewith,

wherein the total amount of the impact resistance modifier and the methyl methacrylate (co)polymer is 100 parts by weight,

wherein the outer layer of said impact resistance modifier and/or said methyl methacrylate copolymer is copolymerized with 0.5 to 40% by weight of a reactive monomer based on the total amount of the impact resistance modifier and the methyl methacrylate (co)polymer as a polymer component, and

wherein the homopolymer of said reactive polymer has an SP value of $9.8 \text{ (cal/cm}^3)^{1/2}$ or more.

2. The resin composition according to claim 1, wherein the outer layer of said impact resistance modifier and/or said methyl methacrylate (co)polymer is copolymerized with 1 to 20% by weight of the reactive

28/31

monomer based on the total amount of the impact resistance modifier and the methyl methacrylate (co)polymer.

3. The resin composition according to claim 1, wherein the SP value of the reactive monomer is $10.8 \text{ (cal/cm}^3)^{1/2}$ or more.

4. The resin composition according to claim 1, wherein the impact resistance modifier and the methyl methacrylate (co)polymer are contained in 80 to 40 parts by weight and 20 to 60 parts by weight, and the total amount thereof is 100 parts by weight.

5. The resin composition according to claim 1, wherein the reactive monomer is one or at least two of a monomer having a nitrile group, an epoxy group, a glycidyl group, a hydroxyl group, a carboxylic acid group, an aldehyde group, an amino group or an amide group.

6. The resin composition according to claim 1, wherein the impact resistance modifier has a two-layer structure and is obtained by polymerizing a monomer mixture containing a (meth)acrylic ester and a copolymerizable monomer in the presence of a crosslinked acrylic rubber.

29/31

7. The resin composition according to claim 1, wherein the impact resistance modifier has a three-layer structure and is obtained by polymerizing an alkyl acrylate, a copolymerizable monomer and a crosslinking monomer in the presence of a polymer obtained by polymerizing methyl methacrylate, a copolymerizable monomer and a crosslinking monomer and then polymerizing a monomer mixture containing a (meth)acrylic ester and a copolymerizable monomer in the presence of the resulting two-layer polymer.

8. The resin composition according to claim 1, wherein a weight ratio of the crosslinked rubber portion and the outer layer portion of said impact resistance modifier according to claim 6 or 7 is 15/85 to 95/5.

9. The resin composition according to claim 1, wherein the capstock is a capstock for a siding panel made of polyvinyl chloride.

10. A siding panel obtained by extrusion-molding the resin composition according to claim 1 as a capstock and a polyvinyl chloride resin as a substrate.

11. A siding panel obtained by extrusion-molding the resin composition according to claim 1 as a capstock

30/31

and a polyvinyl chloride resin as a substrate using a multimanifold die.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US02/11849

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B32B 27/08, 27/28

US CL : 428/518, 522

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 428/518, 522

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — A	US 5,290,857 A (ASHIDA et al) 01 March 1994 (01.03.1994), Abstract.	1-9 ----- 10, 11
X — A	US 3,649,337 A (Johnson et al.) 14 March 1972 (14 March 1972), column 1, lines 51-56.	1-9 ----- 10, 11

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

12 August 2002 (12.08.2002)

Date of mailing of the international search report

09 SEP 2002

Name and mailing address of the ISA/US

Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No. (703)305-3230

Authorized officer

Mullis Jeffrey

Telephone No. 703 306 5665